by Professor Theodore W. Richards, of Harvard University, and Mr. Max E. Lembert, who came to America from the Grand Ducal Technical School of Karlsruhe for this purpose, on the initiative of Professor Bredig and Dr. Fajans. The latter well-known investigator, as well as Sir William Ramsay, Professor Boltwood, Miss Gleditsch and Mr. Miner generously provided the experimenters with residues containing lead of this sort. It was found that all the lead obtained from uraninite, carnotite or thorianite exhibited a lower atomic weight than ordinary lead, the deficiency amounting in one case to as much as 0.75 unit. The ultra-violet spectrum of a typical specimen appeared to be exactly identical with that of ordinary lead. The necessary inference seems to be that lead from radioactive sources consists of a mixture of at least two substances, of which one is ordinary lead. The foreign substance must be very similar to ordinary lead and very difficult if not impossible to eliminate by chemical means; for many precautions were taken to purify the samples. This amazing outcome is contrary to Harvard experience with several other elements, notably copper, silver, iron, sodium and chlorine, each of which has been found to have a constant atomic weight, no matter what the source may have been. The new results on radioactive lead are qualitatively in accord with a recent hypothesis brought forward independently by Fajans, by Russell, and by Soddy, although quantitatively not exactly consistent with it. A preliminary paper, setting forth the detailed methods and results, was sent to press on May 14, and will appear in the July number of the *Journal of the American Chemical Society*. The research was generously subsidized by the Carnegie Institution of Washington.

SPECIAL ARTICLES

THE PRODUCTION OF MALES AND FEMALES CONTROLLED BY FOOD CONDITIONS IN HYDATINA SENTA

THE factors that regulate the production of the sexes in the rotifer *Hydatina senta* have been zealously sought for during the past twenty-five years and various results have been obtained. Temperature, starvation of the young females, unknown external agents, and finally the intangible unknown internal factors, have been decided to be the potent influences that regulate the sex ratio in the parthenogenetic reproduction.

Mitchell[1] has recently experimented with the rotifer *Asplanchna* and has found that a sudden change of the food will bring about the production of a certain one of the polymorphic forms of this rotifer. This particular form of the female produces males. He therefore concludes that a change of food eventually causes male individuals to be produced. He suggests that this food factor may be found to regulate the sex production in *Hydatina senta*.

Some time ago it was shown by Whitney[2] that uniform food conditions caused a production of only females for 289 generations in *Hydatina senta*. Since that time many attempts have been made to find some food conditions that would cause the females to produce only male offspring. Many kinds of mixed cultures of various protozoa have been tried as food and a varied assortment of results have been obtained. This winter pure cultures of several species of protozoa have been grown and more definite results have been obtained. Several kinds of colorless flagellates as well as several kinds of green flagellates were reared and used as food for *Hydatina senta*. Some were tried as a continuous diet and others were used in an interrupted diet. The colorless flagellate, *Polytoma*, was found to be the most satisfactory as a continuous diet for producing only female offspring. A species of the green flagellate *Dunaliella* (Teodor) or *Chlamydomonas* (Cohn) was found to be the most effective in causing the females to produce a high percentage of male offspring by an interrupted diet.

Some fertilized eggs were taken in November from a covered culture jar of rotifers that

[1] *Jour. Exper. Zool.*, Vol. 15, August, 1913.

[2] *Biol. Bull.*, Vol. 22, 1912.

was made in 1908 and had been standing unchanged since that time. A general new culture of rotifers was made from these fertilized eggs and then a few females were selected at random and fed upon a continuous diet of the colorless *Polytoma* in watch glasses. After a few generations a very high percentage of females were produced. At this period adult females were taken from several of the watch glasses and placed in some filtered water from a jar in which a general culture of rotifers were thriving. Then there was added to this culture water the green flagellate, *Dunaliella*.

Experiment	Continuous Polytoma Diet			Adult Females taken from Cultures that had been Living on a Continuous Diet of *Polytoma*, a Colorless Flagellate, for Several Generations and Put upon a New Diet, the Green Flagellate, *Dunaliella*													
	Control			Lot A			Lot B			Lot C			Lot D			Lot E		
	Adult Females	Daughters	Per Cent. of ♂♀ Daughters	Adult Females	Daughters	Per Cent. of ♂♀ Daughters	Adult Females	Daughters	Per Cent. of ♂♀ Daughters	Adult Females	Daughters	Per Cent. of ♂♀ Daughters	Adult Females	Daughters	Per Cent. of ♂♀ Daughters	Adult Females	Daughters	Per Cent. of ♂♀ Daughters
1	5	52	9+	5	50	78	5	47	80+	5	54	75+	5	60	80	5	54	83+
2	5	60	3+	5	51	83+	5	50	74	5	56	82+	5	54	81+			

The controls were also placed in this filtered culture water and the colorless flagellate *Polytoma* was added.

The above table giving the details of two experiments shows the decided and striking results obtained. The continuous diet of *Polytoma* caused the adult females to produce 6 + per cent., as an average, of daughters that were male-producers, while the diet of the green *Dunaliella* that was given to the other adult females caused them to produce as an average 79 + per cent. of daughters that were male-producers.

These experiments are not exceptional, but are only two from many others already completed that are equally as good as these and which were obtained in a series of successive experiments. In all other experiments during the last eight years on *Hydatina senta* there has occurred from time to time a sudden production of males, but such experiments never could be repeated with equal success. Now the male-producing females can be caused to appear at any time from any stock in the laboratory by the sudden change from a continuous diet of *Polytoma* to a diet of the green *Dunaliella*.

Several other green flagellates have been reared and used as food, but they do not seem to be effective in causing males to be produced. Many other observations are being made in a further study of the problem, and the detailed results together with the exact methods used will be published in a later paper.

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[3] Females which produce male offspring.

THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual general meeting of the American Philosophical Society was held in the rooms of the society in Philadelphia, April 23 to 25 inclusive, and constituted a most interesting series of sessions. There was a large number of papers presented, their general character being of a high order of merit and the scope of subjects included being wide.

The meeting was opened on Thursday afternoon, President W. W. Keen, LL.D., in the chair, when the following papers were read:

The Physical Cause of the Unsymmetrical Equilibrium of the Earth Between the Land and Water Hemispheres, with a Theorem on the Attraction of the Terrestrial Spheroid: T. J. J. SEE.

Some Observations on the Psychology of Juries and Jurors: PATTERSON DU BOIS, ESQ.

Factors of Influence in the Origin and Circulation of the Cerebro-spinal Fluid: CHARLES H. FRAZIER.

Aspects and Methods of the Study of the Mechanism of the Heart Beats: ALFRED E. COHN. (Introduced by Dr. Keen.)